OBITUARY

GERARD PETER KUIPER (1905-1973)

Gerard Peter Kuiper, perhaps the most prominent planetary astronomer in the world for many decades, died in Mexico City on 23 December 1973. In the period between the mid-1940's and the mid-1960's Gerard Kuiper was the only full-time professional planetary astronomer engaged in North America, and one of the very few in the world. This was a very lean time for planetary astronomy, in part because of the bad reputation the subject had acquired during the days of Percival Lowell, and in part because of the rich scientific returns offered by stellar and galactic astrophysics. The thread of continuity from the classical period of planetary observation through the present burgeoning interest in this field was provided almost single-handedly by Kuiper. He was eminently successful in applying the techniques of astrophysical research to planetary problems, thereby re-establishing the scientific respectability of the field while producing a long list of discoveries and new insights into cosmogonic problems that had been largely ignored.

In these two decades he applied a range of new war-born technology to planetary astronomy. He had long recognized the importance of the infrared region of the spectrum for planetary observations and with the improved photographic plates and the Cashman lead sulfide cell, he made a number of basic discoveries. Among them were the first detection of carbon dioxide on Mars (now known to be the major atmospheric constituent of this planet); the presence of a methane atmosphere on

Titan, which after a quarter century interval has now proved to be an object of extraordinary interest; the presence of ice on or among the ring particles of Saturn; and the variability of the carbon dioxide abundance above the visible clouds of Venus. In addition to these spectroscopic observations, Kuiper worked in other areas of theoretical and observational planetary studies. He discovered the satellites Nereid of Neptune and Miranda of Uranus; proposed that the lunar maria were basaltic and correctly predicted the bearing strength of the lunar surface; deduced the nature of Mare Orientale; developed his influential protoplanetary hypothesis for solar system cosmogony; suggested that the solar wind was responsible for the removal of hydrogen from the inner solar system during the T-Tauri stage of the sun; proposed the presence of igneous rocks on Mars; suggested that the "irregular" satellites of the Jovian planets--those with high inclination and/or eccentricity--are captured asteroids; proposed that the cloud motions on Jupiter are dominated by an internal heat source, since observed to exist directly; organized the most comprehensive survey of the asteroids ever accomplished; played a leading role in the United States Ranger program of lunar photography; and, in suggesting that Mars might be covered with organisms like lichens, preserved the respectability of exobiology, during a time when the idea of life on other planets was generally rejected.

Kuiper made another major contribution to astronomy in the books he edited. In connection with the 50th anniversary of the Yerkes Observatory, of which he was then Director, the University of Chicago sponsored a symposium on planetary atmospheres in September, 1947.

This was a gathering of planetary astronomers, spectroscopists, meteorologists, geologists, geophysicists, and those working on the earliest phases of rocket exploration of the upper atmosphere. The resulting symposium proceedings, "The Atmospheres of the Earth and Planets," edited by Kuiper, published in 1949 and in a revised edition in 1952, was an extraordinarily useful and important work which has influenced an entire generation of planetary scientists. Kuiper's own Chapter 12 "Planetary Atmospheres and Their Origins" is by far the most widely quoted chapter in the book. Indeed, it would be a fitting tribute for this book to be reissued, since many of the ideas and much of the information it contains still merit the careful attention of students of the field. He also edited or co-edited a four volume series "The Solar System" and a nine volume series "Stars and Stellar Systems," all published by the University of Chicago Press. Kuiper was also co-editor of four lunar atlases, including the first rectified lunar atlas.

Gerard Kuiper was born in Harencarspel, The Netherlands on December 7, 1905, and attended the University of Leiden from which he received his Ph.D. in 1933, under the direction of Einar Hertzsprung. Among his teachers was Paul Ehrenfest. Before assuming a long-time association with the University of Chicago, he held research positions at the Lick Observatory and at Harvard University, where he met his wife Sarah Parker Fuller. He joined the University of Chicago as an Assistant Professor of Astronomy in 1936, becoming full professor seven years later. Kuiper was Director of both the Yerkes and McDonald Observatories between 1947 and 1949 and between 1957 and 1960 and, for a period, Chairman of the Department of Astronomy

at the University of Chicago. In 1960 he left for the University of Arizona where he founded the Lunar and Planetary Laboratory.

Among his primary concerns during his first decade of work in the United States were white dwarfs, and double and multiple star systems. His interest in double stars was strongly motivated by the idea that they were one end of a mass-ratio distribution function at the other end of which were planetary systems; indeed one of his most striking results is the Kuiper histogram of mean separations of members of double star systems, which show typical separation values comparable to the distances of the major planets from the Sun.

Planetary astronomers who worked as his students include Dan Harris, Tom Gehrels, William Hartmann, Alan Binder, Dale Cruikshank, and the present authors. His influence on the field went far beyond his own students, however, as he was a member of numerous scientific committees, engaged in many collaborative investigations with scientists in a wide variety of disciplines, and was always happy to provide information and encouragement to anyone seriously interested in planetary problems. We can remember as undergraduates in the early fifties--those far off days when there was usually a certain respectful distance between students and their professors--being treated with uncommon warmth and enthusiasm on visits to the Yerkes Observatory. Our graduate careers were separated by four years, Sagan graduating at Yerkes and Owen at the University of Arizona. Kuiper's style of supervision of graduate students and others varied from case to case. For us, he provided advice and inspiration on specific problems, but left the general development of the thesis topic in the student's own hands.

Kuiper had a rare simultaneous talent for observational, laboratory, and theoretical approaches to planetary problems, although his chief love was to be at the telescope. This multi-faceted approach to the subject was one of his main motivations in moving to the University of Arizona in 1960. With the founding of the Lunar and Planetary Laboratory, he hoped to be in a position to promote all three aspects while taking advantage of the geological features and excellent observing conditions in the Tucson area. His planetary spectroscopy program was revitalized with the development of new infrared spectrometers and led to more discoveries such as the determination of isotopic ratios for the CO_2 on Venus, the detection of water vapor on omicron Ceti and an airborne spectroscopy program which included the production of a high-altitude atlas of the solar spectrum and measurements of the water vapor abundance on Venus. The lunar mapping work was continued, including the production of a Consolidated Lunar Atlas that contained exquisitely detailed ground-based photographs of the moon that were obtained with the 61-inch telescope at the Catalina Observatory that Kuiper founded. Examples of the beautiful planetary photography obtained with this telescope have appeared from time to time in Sky and Telescope, most recently in a discussion by Kuiper of the colors on Jupiter and the nature of the Great Red Spot,* and in the Communications of the Lunar and Planetary Laboratory, a publication Kuiper initiated in 1962. The LPL Observatories included telescopes optimized for infrared work, and the advances in infrared astronomy made under the leadership of Frank Low and Harold Johnson were one of the great early (and continuing) contributions of the Lunar and Planetary

Laboratory.*

Kuiper early saw the enormous significance for solar system astronomy of the rocket motors being developed in the 1950's, and played a major part in the unmanned lunar programs of the 1960's and in the support of subsequent planetary missions. Yet he never lost sight of the important role to be played by the classical approaches to the problem. He was continually experimenting with new instrumental developments, exploiting new observational techniques, and searching for new and better sites for the construction of observatories. All of us who were associated with him can recall the intensity with which he would support these enthusiasms. While engaged in more than his statistical expectation value of scientific controversy, Kuiper was an extremely gracious and constructive public personality. He was a man of his times and his social attitudes changed in response to changing times. The German invasion of Holland was a matter of immense concern for him and, among several other military and scientific endeavors during the Second World War, Kuiper served on the ALSOS mission which followed the American front lines into Germany at the close of World War II to determine the level of German scientific advance in, for example, nuclear weapons and rocketry. For these efforts he was decorated Knight Commander of the Order of Orange and Nassau by the Queen of The Netherlands, a country which has produced such a disproportionately large fraction of distinguished astronomers.

Gerard Peter Kuiper was a dedicated man with a passion for the planets, and he will be missed. The Mariner 10 imaging team, of which he was a member, has proposed to the IAU that a prominent bright ray crater on Mercury be named Kuiper. It is a fitting and lasting memorial.

*A comprehensive discussion of the Lunar and Planetary Laboratory and its programs was published by Kuiper in Sky and Telescope (Jan. and Feb., 1964 and Jan. and Feb., 1972).